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"Photometry of the Planets"

Astronomy Department

The University of Arizona

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Distribution list: Chief of Naval Research, Attn: Geography Branch;
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Publication of the Work on Reflection Nebulae

Partly with previous ONR support, the study of the polarization in reflection nebulae was completed and published in the Astronomical Journal and in the McDonald Observatory Contributions. This work included an intercomparison with the Mie theory of scattering by small particles and an intercomparison with the measurements of interstellar polarization. A reprint is attached.

Publication of Observations of Asteroid Lightcurves

Previous ONR support helped us to get started with a program of observations of asteroid lightcurves. This has now become a more extensive program, especially because the reductions and the analysis of the data is a big job, and the support is taken over by the National Aeronautics and Space Administration. The first paper of this jointly supported work is about to appear in the Astronomical Journal and reprints will be submitted to the ONR distribution list soon as they become available.

The Abstract of this paper is as follows:

A set of 13 light curves for 4 Vesta was obtained between November 1958 and May 1959. The set is compared with light curves observed in 1950 (by H. L. Johnson), in 1952 (D. L. Harris), in 1954 (L. Binnendijk), and in 1967 (this paper). The speed as well as the sense of rotation are derived from the effect of aspect change on the apparent rotational period ("photometric astrometry"). The rotation is direct, the true period is $5^h20^m31^s.665$ ($\pm 0^s.003$ p.e.), and the ecliptic longitude and latitude of the north pole are 126° (±5°) and +65° (±4°). Vesta differs from the other asteroids in that its light curve has only one maximum and one minimum, indicating a nearly spherical shape for Vesta with a darker, and slightly bluer, region on one side. The brightness-phase function shows a nonlinear increase near opposition ("opposition effect"). The colors B-V and U-B increase with the orbital phase angle ("reddening with phase").

Polarization Measurements of the Crab Nebula

First exploratory measurements were made with the 21-inch Catalina reflector, as reported in the Quarterly Progress Report of 30 June 1967. The Crab was setting at this time, and the series of measurements was incomplete However, great promise is shown and the work will be continued

Publication of a Paper on Mu Cephei

A paper by Coyne and Kruszewski has been accepted for publication in the Astronomical Journal, and reprints will be sent to this distribution list as soon as they become available.

The Abstract of the paper is as follows:

New polarimetric observations of μ Cephei in nine spectral regions made during the years 1965-67 are presented. These are combined with other polarimetric and photometric observations in a discussion of the wavelength and time dependence of the polarization of this star. Large changes in polarization occur in the course of a few months. The wavelength dependence of polarization varies with time. The polarization position angle for the intrinsic component of this star's polarization varies both with time and with wavelength. The predominant presence of intrinsic polarization may indicate that at least a part of the reddening of this star can be of circumstellar origin. This casts doubts on the applicability of the conclusion about the absence of ice particles, based on the Stratoscope II observations of μ Cephei, to the general interstellar medium. Also, this star should not be used in the determination of the interstellar absorption-to-redding ratio.

Work on the Intrinsic Stellar Polarizations T

Serkowski, Kruszewski, and Gehrels have completed a manuscript on the intrinsic polarizations observed on other red stars. This paper will be submitted for publication in the Astronomical Journal shortly, and reprints will be sent to the ONR distribution list as soon as they are available.

The Abstract of this paper is as follows:

Twenty-three red variable stars were observed for polarization in several spectral regions in the range 0.3 - 1.0 μ. The polarization steeply rises into ultraviolet attaining in some cases at least 8%. The rate of the increase is generally faster than the $1/\lambda$ law. The carbon stars differ from the M-type stars by higher occurrence of larger polarizations and by flat wavelength dependence in yellow-blue. Both degree of polarization and position angle usually show large variations with time. The better observed stars show changes in polarization closely correlated with the light variations. The wavelength dependence of polarization also changes in time. The steep wavelength dependence can be explained by the molecular scattering in an extended assymetric envelope; however a simple model of such an envelope gives the maximum polarization equal to 5.5% -- smaller than the observed values. The absorption by graphite platelets can work in carbon stars but it cannot explain the generally large polarizations in M-type stars.

The support by the Office of Naval Research has helped us getting started in various new explorations. The greatest example in my case is that of the high-altitude ballooning; the first discussions of problems and solutions were held at ONR Headquarters and these discussions were quite stimulating and helpful. ONR even helped us to find the appropriate amount of financial support for this "Polariscope program" which has now become almost a successful routine.

Several of my students and colleagues and I are indebted to the Office of Naval Research in General, and to Miss Jean E. Streeter in particular, for the support and the encouragement of our work.

Tom Gehrels
Tucson, Arizona
30 September 1967